

**ARCHITECTURAL DESIGN TOOLS FOR DEVELOPING STUDENT SPACE  
IMAGINATION IN TEACHING SCIENCES**

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**Abstract:** *The article presents the tools and methods of intensive development of students' spatial imagination in the teaching of the subject of architectural design using computer technology and computer graphics.*

**Keywords:** **architectural design, spatial imagination, virtual models, video lessons, computer graphics.**

As part of the reform of the education system in Uzbekistan, the concept of development of the higher education system until 2030 includes "accelerating the process of studying and implementing best international practices to improve the quality of education and improving teaching methods" [1], training competitive personnel and their worthy contribution to economic development. As a result of reforms in the system, great attention is paid to the inclusion of higher education institutions in the list of the top 1,000 higher education institutions in the ranking of internationally recognized organizations. The Action Strategy for the Further Development of the Republic of Uzbekistan for 2017-2021 sets the priority task of "improving the quality and efficiency of higher education institutions based on the introduction of international standards for assessing the quality of education and training". The training of talented, broad-minded, competitive personnel and their place in society in the implementation of the tasks set out in goals 46-51 of the new Development Strategy of Uzbekistan for 2022-2006, the establishment of grand plans for the overall development of the state depends on the requirements of today's education system. Extensive reforms are being carried out in the education system to ensure the quality stage. Goal: quality education, competitive staff, development of the young generation of inventors and innovators.

R.Khorunov, I.Rakhmonov, A.Kholmiraev, Sh.Murodov, D.Kuchkarova, E.Ruziev, A.Khamrakulov, S.Sh. .Saydaliev, D.Saidahmedova, B.Khaitov, A.A.Kahharov, N.Yadgorov and others.

Modern issues of teaching subjects "Architectural design", "Architectural theory" Sh.R. Boboyorova, R.B. Abdurahimov. Uzbek and foreign scientists such as A.A.Ziyaev, T.Sh.Mamatmusaev, M.Roziqberdiev, M.Akhmedov, S.Bulatov, B.G.Barkhin, K.T.Zaytsev conducted research.

As a result of research, studies and observations, it was found that the graphic competencies and spatial perceptions of 1st year students entering higher education vary (low, medium, high). The main reasons for this are that the subject of drawing is not taught in lyceums, vocational schools and

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colleges (social sciences, humanities, medicine and economics). It is obvious that the students entering higher education institutions have different potential, understanding and imagination in the field of drawing and design, that is, their spatial imagination.

Imagination is the process of remembering things and events, situations, images of reality, as well as creative imagination. Enriching the imagination with new images plays an important role in solving thinking tasks. Imagination is important in the acquisition of knowledge, in the acquisition of professional skills.

An important aspect of the imaginary imagination for man is that with the help of this imagination a person anticipates the future object, the thing. For example, an engineer imagines the machine he wants to create from his schematic. The architect imagines from the sketch he drew the building he wanted to build.

Spatial imagination is a complete understanding of the shape, size, appearance, condition of the object, drawing, object, detail, etc., and its characteristics. It is understood that a drawing, detail, etc., can be imagined by the human imagination and can be drawn on paper [14].

One of the major problems in teaching the subject of "Architectural Design" in higher education institutions is the lack of time (drawing on the board, redrawing and explaining) due to insufficient development of spatial imagination and design skills. Gives a positive result by applying digital methodology to the learning process in solving an existing problem. The use of intensive methods is especially important in the development of spatial imagination, design skills, creative and independent work skills in students.

According to A. Khamrakulov, "...demonstration of spatial solutions before solving problems attracts students to independent thinking and creative approach to the problem, as well as provides an opportunity to show what students do not understand until they understand it again. Also, if there are interactive models of this type of problem, students will complete their assignments in interactive models. By entering the parameters of the tasks in the interactive model, the task solution appears on the screen"[8].

Experimental work on the development of students' spatial imagination, design skills on the basis of intensive methods in teaching the subject "Architectural Design" was carried out. For this purpose, digital methodological software (theoretical information, set of tasks, intellectual computer games, video lessons, multiple-choice test control questions, virtual models) on the subject of "Architectural Design" was created.

In teaching the subject "Architectural Design" used the opportunities of multimedia computer technology to develop students' spatial imagination, design skills. Video lessons for lectures and practical lessons on digital methodology aimed at developing students' spatial imagination, design skills, stratified multivariate tests were created to analyze the development of students' spatial imagination, design skills. Using the capabilities of computer graphics, the development and creation of virtual models of buildings, intellectual computer games to develop the spatial imagination of students.

Drawings and projects in the subject "Architectural Design" allow students to present their knowledge in a convenient, simple and effective way by explaining the topics using the capabilities of AutoCAD, ArchiCAD, 3dxMAX, Lumion graphics, virtual modeling (2D, 3D) and interactive details, modeling.

There are a number of programs that can be used in the learning process of engineering computer graphics, such as AutoCAD, ArchiCAD, Compas, 3dsMax, CorelDraw, Lumion. However, among these programs AutoCAD graphics program is effective in drawing on the subject of "Architectural design", and 3dsMax program is effective in all types of educational process through modeling, transformation of the virtual model of the project in Lumion into a multimedia form in video form.

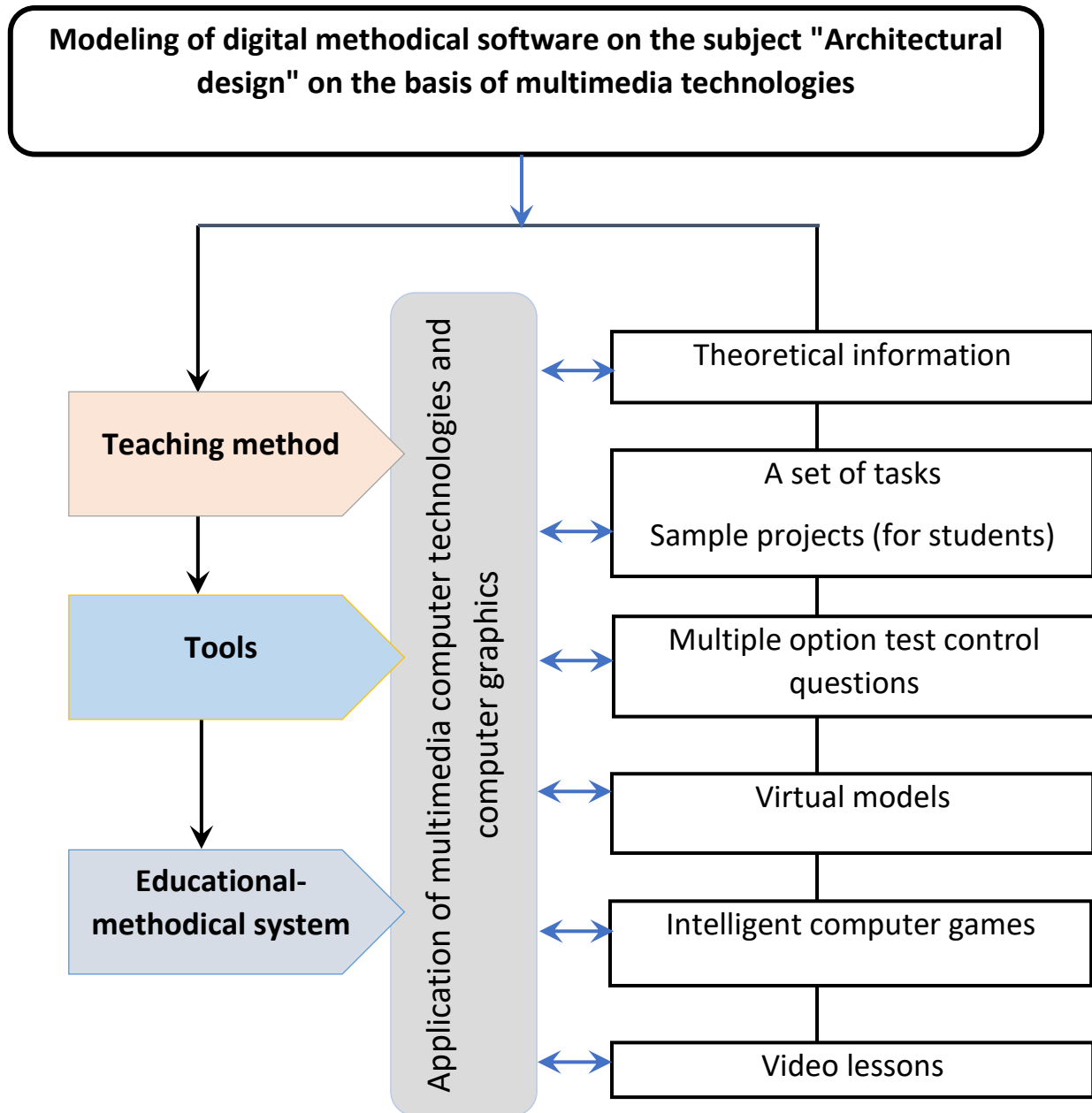


Figure 1. Spatial imagination of students on the subject "Architectural Design", a pedagogical model for the development of design skills.

Through the standard details and model drawings in AutoCAD, students can develop spatial imagination and design skills. These details can be made in different ways by using the necessary dimensions in the creation. This opportunity can be compared to a virtual experience stand. In addition, its parameters, as well as the necessary editing of details and projects, allow students to effectively master the knowledge of the subject.

Depending on the type of lesson, the science teacher determines and allocates time for the use of multimedia computer technology and computer graphics. As a result, it is advisable to use a multimedia electronic textbook or computer graphics for the necessary part of the lesson time to understand the information provided to students on the topic, to use drawing details, spatial imagination of assignments. In this case, the information provided through animation, video, video, visual, illustrative, etc., plays an important role in the spatial representation of information acquired by students. The student acquires the knowledge he receives only when he imagines the appearance, condition, condition, shape, size of the drawings.

It is known from the developed educational experience that the creation of opportunities for independent learning, the availability of the necessary information on the subject in a modern form is the main source of independent learning of students. The digital methodology developed on the subject of "Architectural Design" is designed to provide excellent knowledge in all types of education. In addition, opportunities for independent and distance learning to obtain information on the subject, study and control the acquired knowledge have been developed. In digital methodology, themed project drawings can be viewed and studied in animated and video form. In addition, the possibility of analyzing and editing models of projects using computer graphics is the basis for the formation of students' comprehensive knowledge and skills, on the basis of which the development of spatial imagination.

In design sciences, the presentation of students' spatial imagination on the basis of visual, visual, illustrative, conceptual materials is the fastest, most understandable, developmental value.

In order to determine the accuracy of the scientific hypothesis, experimental work on teaching the subject "Architectural Design" using multimedia computer technology and computer graphics was conducted regularly during the academic semester. Experimental and control groups were selected for the study at the Namangan Institute of Civil Engineering: 1st control group (32-QXALTE-19), 2nd experimental group (33-QXALTE-19). The experiments were performed in weeks. Experimental tests yielded the expected results. Compared to the control group, the mastering rate of the experimental group was observed to be on average 12.2% higher.

### Conclusion

Observation of students' lessons, examination of students' projects, analysis and analysis of the results of interviews with professors, surveys revealed that the use of digital teaching aids in teaching is more useful than other types of teaching methods..

At the stage of finding solutions to problems was carried out on the basis of digital methodological support in the learning process. Interviews with students, questionnaires, the use of digital methodology in architectural design classes showed an increase in interest and mastery of science in students, as well as the development of project thinking and skills in students..

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